Ground Water Quality Assessment of a Contaminated Site in Kerala

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Abstract –The Water Quality Index (WQI) is an important tool to determine the quality of drinking water in rural, urban and industrial area. WQI is a single number which can be calculated easily and used for overall description of the quality of waterbodies. The present study is an investigation on the groundwater quality of the municipal dump site in Kureepuzha which had an abandoned solid waste dump yard. The dumping was discontinued around 2012 due to public protest. this has been determined by collecting groundwater samples at different points around the dumpsite in the poly-ethylene bottles and subjecting the samples to a comprehensive physio-chemical analysis. For calculating the water quality index certain parameters has been considered: pH, turbidity, electrical conductivity, acidity, alkalinity, sulphate, total dissolved solids, total hardness, calcium, magnesium, chloride, fluoride, iron, nitrates. Then the results are compared with the Indian Standards of the drinking water (BIS-10500-1991). By using weighted arithmetic method, the WQI is analyzed. And the spatial distribution of WQI is mapped using Arc GIS software.

Key Words: Water Quality Index, Drinking water, Weighted arithmetic method, Groundwater, Indian standards, Kureepuzha.

1.INTRODUCTION

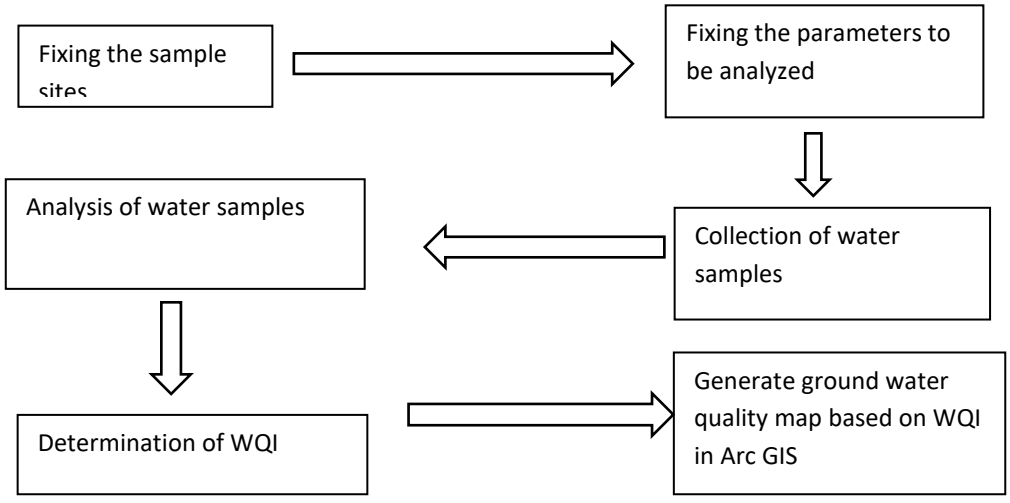
1.1 General

Groundwater occurs in the saturated soil and rock below the water table and is a part of the natural water cycle. Groundwater, which is in aquifers below the surface of the earth, is one of the nation's most important natural resources. Even though limited ground water resources available in Kerala, groundwater is one of the major sources of fresh water, especially in rural habitations in the state, has come under increasing stress in recent decades due to increasing exploitation and contamination. A WQI is a mean to summarize large amounts of water quality data into simple term (e.g., good) and makes the surface water quality analysis convenient.

1.2 Objectives of the Project

1. To analyse physio-chemical water quality parameters of well water samples
2. To develop Water Quality Index (WQI)
3. To develop spatial distribution map of WQI using ArcGIS

2. METHODOLOGY



3. STUDY AREA

Kureepuzha is a peninsula region in the city of Kollam, Kerala located on the shore of Ashtamudi lake. Kollam municipal corporation is operating a municipal waste composting plant and disposal site at 6 Km away from the city centre, functioning since 2002, but abandoned in 2012. The site is in the midst of thickly inhabited area and therefore would not be suitable for establishment of the integrated solid waste treatment plant.

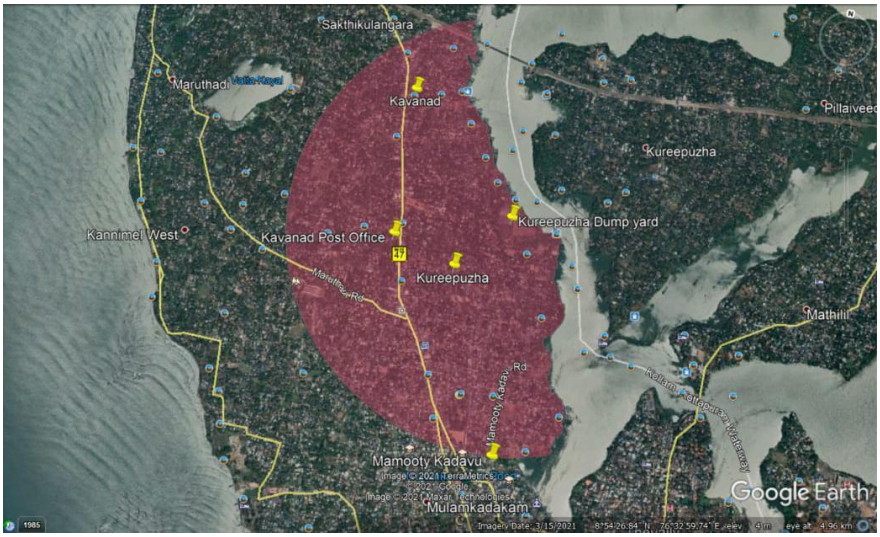


Fig-1: Study area

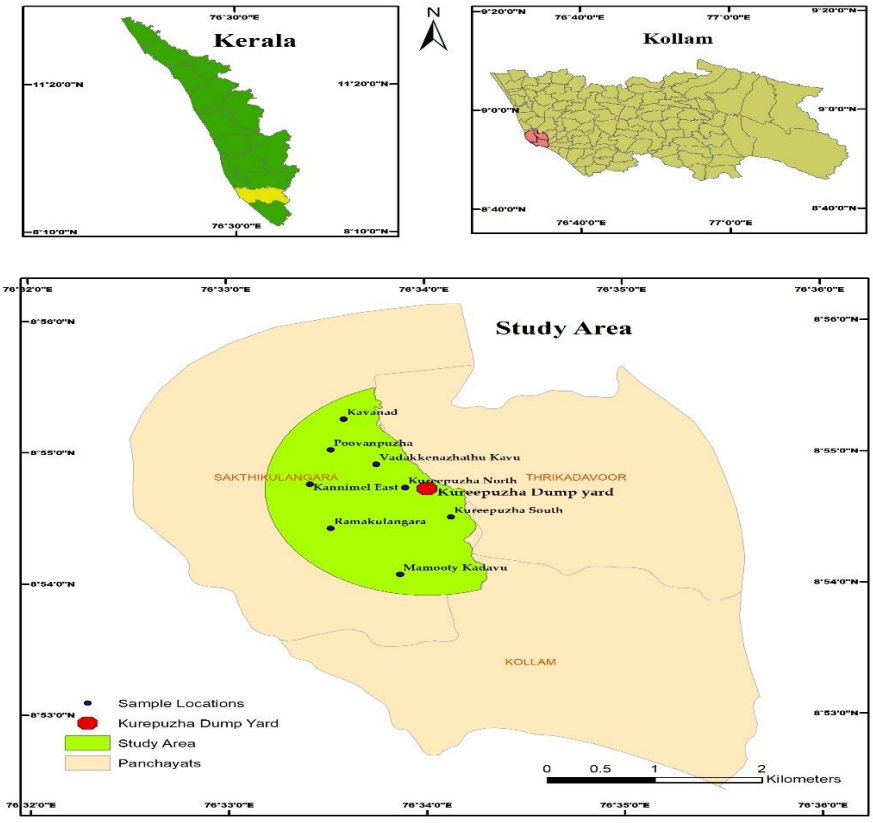


Fig-2: Study area map

4. RESULTT AND DISCUSSION

4.1 Sampling Sites Fixed

1500m radius area from waste dumping yard is fixed for collecting samples. One side of waste dumping yard Ashtamudi lake is located, that side is excluded.

Table-1: Sampling site location

Field	Latitude	Longitude
Station 1	76°33'45.00''N	8°54'54.29''E
Station 2	76°33'53.72''N	8°54'43.62''E
Station 3	76°33'52.03''N	8°54'03.89''E
Station 4	76°34'07.60''N	8°54'30.06''E
Station 5	76°33'31.28''N	8°55'00.97''E
Station 6	76°33'35.25''N	8°55'15.01''E
Station 7	76°33'24.96''N	8°54'45.33''E
Station 8	76°33'31.12''N	8°54'25.11''E

4.2 Parameters Fixed for the Water Quality Analysis

Table-2: Parameters fixed

Parameters	Unit	Drinking Water Unit
Turbidity	NTU	5
pH	-	8.5
Electrical conductivity at 25°C	(micro mhos/cm)	300
Acidity	mg/l	
Alkalinity	mg/l	200
Sulphates (as SO_4)	mg/l	200
Total Dissolved Solids (TDS)	mg/l	500
Total Hardness (as $CaCO_3$)	mg/l	200
Calcium (as Ca)	mg/l	75
Magnesium (as Mg)	mg/l	30
Chloride (as Cl)	mg/l	250
Fluoride (as F)	mg/l	1
Iron (as Fe)	mg/l	0.3
Nitrate (as NO_3)	mg/l	45

4.3 Collection of Water Samples

8 samples were collected on 29 th January 2021. Collection was done in pre monsoon season.

4.4 Analysis of Water Samples

Water were tested in Kerala Water authority Quality control, kollam dist.

Table-3: Test result of samples

Sl. No	Characteristics	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8
1	Turbidity	0.89	0.84	0.65	0.78	0.62	0.73	0.76	0.74
2	pH	4.45	5.24	5.54	4.8	4.76	4.56	5.69	6.39
3	Electrical conductivity at 25^0C	281.9	272.4	277.1	283.8	345.7	304.7	32.1	358
4	Acidity	8	7	10	7	9	12	7	10
5	Alkalinity	13	15.2	21.7	18.2	10.9	13	17.3	76.1
6	Sulphate (as SO_4)	1.94	2.33	6.84	5.76	1.91	1.23	3.18	6.89
7	Total Dissolved solids (TDS)	143	141	142	158	190	162	170	183
8	Total Hardness (as $CaCO_3$)	40.3	33	42.2	32.5	45.8	36.7	55	73.4
9	Calcium (as Ca)	11	11	11	11.3	11	13.2	15.4	25.7
10	Magnesium (as Mg)	3.1	1.3	3.6	3.4	4.4	0.9	4	2.2
11	Chloride (as Cl)	58.1	48.1	48.1	48.2	57.7	42.3	57.7	48.1
12	Fluoride (as F)	0.821	0.931	0.602	0.854	0.561	0.512	0.723	0.822
13	Iron (as Fe)	0.009	0.018	0.005	0.019	0.008	0.006	0.003	0.007
14	Nitrate (as NO_3)	37.83	35.09	34.8	37.1	37.64	37.32	37.04	32.26

4.5 Water Quality Index

4.5.1 Weighted Arithmetic Index Method

Weighted Arithmetic Method which was originally proposed by Horton (1965) and developed by Brown Etal. (1972). This method incorporates data from multiple water quality parameters into mathematical equation that rates the health of water body with number.

Step 1: Calculate the unit weight (Wn)

Wn=K/Sn

Where,

K=1/(∑1/Sn)

Sn= standard desirable value

On summation of all selected parameters unit weight factors, Wn =1

Step 2: calculate the sub index (Qn)

Qn=[(Vn-Vo)/(Sn-So)] *100

Vn = Mean concentration

Sn = Standard desirable value

Vo = Actual value of the parameter of the pure water (generally Vo=0 for most parameters except for pH)

QpH=[(VpH-7)/ (8.5-7)] *100

Step 3: WQI is calculate

$$\text{Overall WQI}=\frac{\sum WnQn}{\sum Wn}$$

Table- 4: Rating of WQI

Water Quality Index	Water Quality Status
0-25	Excellent
26-50	Good
51-75	Poor
76-100	Very poor
>100	Unfit for consumption

5. CALCULATION OF WQI

Table-5: Calculation of WQI-Site1

SITE 1											
Charecteristics	BIS standards(Sn)	1/Sn	∑1/Sn	K=1/(∑1/Sn)	Wi=K/Sn	IDEAL VALUE (V0)	MEAN CONC.VALUE(Vn)	Vn/Sn	Vn/Sn*100=Qn	Wnqn
Turbidity	5	0.2	4.744203	0.21078358	0.042156716	0	0.89	0.178	17.8	0.75039
pH	8.5	0.117647	4.744203	0.21078358	0.024798068	7	4.45	1.7	170	4.215672
Electrical conductivity at 25^{0}C	300	0.003333	4.744203	0.21078358	0.000702612	0	281.9	0.939667	93.96666667	0.066022
Acidity			4.744203				8		0	0
Alkalinity	200	0.005	4.744203	0.21078358	0.001053918	0	13	0.065	6.5	0.00685
Sulphate (as SO_4)	200	0.005	4.744203	0.21078358	0.001053918	0	1.94	0.0097	0.97	0.001022
Total Dissolved solids (TDS)	500	0.002	4.744203	0.21078358	0.000421567	0	143	0.286	28.6	0.012057
Total Hardness (as $CaCO_3$)	200	0.005	4.744203	0.21078358	0.001053918	0	40.3	0.2015	20.15	0.021236
Calcium (as Ca)	75	0.013333	4.744203	0.21078358	0.002810448	0	11	0.146667	14.66666667	0.04122
Magnesium (as Mg)	30	0.033333	4.744203	0.21078358	0.007026119	0	3.1	0.103333	10.33333333	0.072603
Chloride (as Cl)	250	0.004	4.744203	0.21078358	0.000843134	0	58.1	0.2324	23.24	0.019594
Flouride (as F)	1	1	4.744203	0.21078358	0.210783578	0	0.821	0.821	82.1	17.30533
Iron (as Fe)	0.3	3.333333	4.744203	0.21078358	0.702611925	0	0.009	0.03	3	2.107836
Nitrate (as NO_3)	45	0.022222	4.744203	0.21078358	0.00468408	0	37.83	0.840667	84.06666667	0.393775
	1814.8	4.744203			1					25.01361

Table-6: Calculation of WQI-Site2

SITE 2										
Charecteristics	BIS standards(Sn)	1/Sn	∑1/Sn	K=1/(∑1/Sn)	Wi=K/Sn	IDEAL VALUE (V0)	MEAN CONC.VALUE(Vn)	Vn/Sn	Vn/Sn*100=Qn	WnQn
Turbidity	5	0.2	4.744203	0.21078358	0.042156716	0	0.84	0.168	16.8	0.708233
pH	8.5	0.117647	4.744203	0.21078358	0.024798068	7	5.24	1.17	117	2.901374
Electrical conductivity at 25^{0}C	300	0.003333	4.744203	0.21078358	0.000702612	0	272.4	0.908	90.8	0.063797
Acidity			4.744203				7			0
Alkalinity	200	0.005	4.744203	0.21078358	0.001053918	0	15.2	0.076	7.6	0.00801
Sulphate (as SO_4)	200	0.005	4.744203	0.21078358	0.001053918	0	2.33	0.01165	1.165	0.001228
Total Dissolved solids (TDS)	500	0.002	4.744203	0.21078358	0.000421567	0	141	0.282	28.2	0.011888
Total Hardness (as $CaCO_3$)	200	0.005	4.744203	0.21078358	0.001053918	0	33	0.165	16.5	0.01739
Calcium (as Ca)	75	0.013333	4.744203	0.21078358	0.002810448	0	11	0.146667	14.66666667	0.04122
Magnesium (as Mg)	30	0.033333	4.744203	0.21078358	0.007026119	0	1.3	0.043333	4.333333333	0.030447
Chloride (as Cl)	250	0.004	4.744203	0.21078358	0.000843134	0	48.1	0.1924	19.24	0.016222
Flouride (as F)	1	1	4.744203	0.21078358	0.210783578	0	0.931	0.931	93.1	19.62395
Iron (as Fe)	0.3	3.333333	4.744203	0.21078358	0.702611925	0	0.018	0.06	6	4.215672
Nitrate (as NO_3)	45	0.022222	4.744203	0.21078358	0.00468408	0	35.09	0.779778	77.97777778	0.365254
	1814.8	4.744203			1					28.00468

Table-7: Calculation of WQI -Site3

SITE 3										
Charecteristics	BIS standards(Sn)	1/Sn	∑1/Sn	K=1/(∑1/Sn)	Wi=K/Sn	IDEAL VALUE (V0)	MEAN CONC.VALUE(Vn)	Vn/Sn	Vn/Sn*100=Qn	WnQn
Turbidity	5	0.2	4.744203	0.21078358	0.042156716	0	0.65	0.13	13	0.548037
pH	8.5	0.117647	4.744203	0.21078358	0.024798068	7	5.54	0.97	97	2.405413
Electrical conductivity at 25^{0}C	300	0.003333	4.744203	0.21078358	0.000702612	0	277.1	0.923667	92.36666667	0.064898
Acidity			4.744203				10			0
Alkalinity	200	0.005	4.744203	0.21078358	0.001053918	0	21.7	0.1085	10.85	0.011435
Sulphate (as SO_4)	200	0.005	4.744203	0.21078358	0.001053918	0	6.84	0.0342	3.42	0.003604
Total Dissolved solids (TDS)	500	0.002	4.744203	0.21078358	0.000421567	0	142	0.284	28.4	0.011973
Total Hardness (as $CaCO_3$)	200	0.005	4.744203	0.21078358	0.001053918	0	42.2	0.211	21.1	0.022238
Calcium (as Ca)	75	0.013333	4.744203	0.21078358	0.002810448	0	11	0.146667	14.66666667	0.04122
Magnesium (as Mg)	30	0.033333	4.744203	0.21078358	0.007026119	0	3.6	0.12	12	0.084313
Chloride (as Cl)	250	0.004	4.744203	0.21078358	0.000843134	0	48.1	0.1924	19.24	0.016222
Flouride (as F)	1	1	4.744203	0.21078358	0.210783578	0	0.602	0.602	60.2	12.68917
Iron (as Fe)	0.3	3.333333	4.744203	0.21078358	0.702611925	0	0.005	0.016667	1.666666667	1.17102
Nitrate (as NO_3)	45	0.022222	4.744203	0.21078358	0.00468408	0	34.8	0.773333	77.33333333	0.362235
	1814.8	4.744203			1					17.43178

Table-8: Calculation of WQI-Site4

SITE 4											
Charecteristics	BIS standards(Sn)	1/Sn	∑1/Sn	K=1/(∑1/Sn)	Wi=K/Sn	IDEAL VALUE (V0)	MEAN CONC.VALUE(Vn)	Vn/Sn	Vn/Sn*100=Qn	WnQn
Turbidity	5	0.2	4.744203	0.21078358	0.042156716	0	0.78	0.156	15.6	0.657645
pH	8.5	0.117647	4.744203	0.21078358	0.024798068	7	4.8	1.46	146	3.620518
Electrical conductivity at 25^0C	300	0.003333	4.744203	0.21078358	0.000702612	0	283.8	0.946	94.6	0.066467
Acidity			4.744203				7			0
Alkalinity	200	0.005	4.744203	0.21078358	0.001053918	0	18.2	0.091	9.1	0.009591
Sulphate (as SO_4)	200	0.005	4.744203	0.21078358	0.001053918	0	5.76	0.0288	2.88	0.003035
Total Dissolved solids (TDS)	500	0.002	4.744203	0.21078358	0.000421567	0	158	0.316	31.6	0.013322
Total Hardness (as $CaCO_3$)	200	0.005	4.744203	0.21078358	0.001053918	0	32.5	0.1625	16.25	0.017126
Calcium (as Ca)	75	0.013333	4.744203	0.21078358	0.002810448	0	11.3	0.150667	15.06666667	0.042344
Magnesium (as Mg)	30	0.033333	4.744203	0.21078358	0.007026119	0	3.4	0.113333	11.33333333	0.079629
Chloride (as Cl)	250	0.004	4.744203	0.21078358	0.000843134	0	48.2	0.1928	19.28	0.016256
Flouride (as F)	1	1	4.744203	0.21078358	0.210783578	0	0.854	0.854	85.4	18.00092
Iron (as Fe)	0.3	3.333333	4.744203	0.21078358	0.702611925	0	0.019	0.063333	6.333333333	4.449876
Nitrate (as NO_3)	45	0.022222	4.744203	0.21078358	0.00468408	0	37.1	0.824444	82.44444444	0.386176
	1814.8	4.744203			1					27.3629

Table-9: Calculation of WQI-Site5

SITE 5										
Charecteristics	BIS standards(Sn)	1/Sn	∑1/Sn	K=1/(∑1/Sn)	Wi=K/Sn	IDEAL VALUE (V0)	MEAN CONC.VALUE(Vn)	Vn/Sn	Vn/Sn*100=Qn	WnQn
Turbidity	5	0.2	4.744203	0.21078358	0.042156716	0	0.62	0.124	12.4	0.522743
pH	8.5	0.117647	4.744203	0.21078358	0.024798068	7	4.76	1.49	149	3.694912
Electrical conductivity at 25^0C	300	0.003333	4.744203	0.21078358	0.000702612	0	345.7	1.152333	115.2333333	0.080964
Acidity			4.744203				9		0	0
Alkalinity	200	0.005	4.744203	0.21078358	0.001053918	0	10.9	0.0545	5.45	0.005744
Sulphate (as SO_4)	200	0.005	4.744203	0.21078358	0.001053918	0	1.91	0.00955	0.955	0.001006
Total Dissolved solids (TDS)	500	0.002	4.744203	0.21078358	0.000421567	0	190	0.38	38	0.01602
Total Hardness (as $CaCO_3$)	200	0.005	4.744203	0.21078358	0.001053918	0	45.8	0.229	22.9	0.024135
Calcium (as Ca)	75	0.013333	4.744203	0.21078358	0.002810448	0	11	0.146667	14.66666667	0.04122
Magnesium (as Mg)	30	0.033333	4.744203	0.21078358	0.007026119	0	4.4	0.146667	14.66666667	0.10305
Chloride (as Cl)	250	0.004	4.744203	0.21078358	0.000843134	0	57.7	0.2308	23.08	0.01946
Flouride (as F)	1	1	4.744203	0.21078358	0.210783578	0	0.561	0.561	56.1	11.82496
Iron (as Fe)	0.3	3.333333	4.744203	0.21078358	0.702611925	0	0.008	0.026667	2.666666667	1.873632
Nitrate (as NO_3)	45	0.022222	4.744203	0.21078358	0.00468408	0	37.64	0.836444	83.64444444	0.391797
	1814.8	4.744203			1					18.59964

Table-10: Calculation of WQI-Site 6

SITE 6										
Charecteristics	BIS standards(Sn)	1/Sn	∑1/Sn	K=1/(∑1/Sn)	Wi=K/Sn	IDEAL VALUE (V0)	MEAN CONC.VALUE(Vn)	Vn/Sn	Vn/Sn*100=Qn	WnQn
Turbidity	5	0.2	4.744203	0.21078358	0.042156716	0	0.73	0.146	14.6	0.615488
pH	8.5	0.117647	4.744203	0.21078358	0.024798068	7	4.56	1.6267	162.67	4.033902
Electrical conductivity at 25^0C	300	0.003333	4.744203	0.21078358	0.000702612	0	304.7	1.015667	101.5666667	0.071362
Acidity			4.744203				12			0
Alkalinity	200	0.005	4.744203	0.21078358	0.001053918	0	13	0.065	6.5	0.00685
Sulphate (as SO_4)	200	0.005	4.744203	0.21078358	0.001053918	0	1.23	0.00615	0.615	0.000648
Total Dissolved solids (TDS)	500	0.002	4.744203	0.21078358	0.000421567	0	162	0.324	32.4	0.013659
Total Hardness (as $CaCO_3$)	200	0.005	4.744203	0.21078358	0.001053918	0	36.7	0.1835	18.35	0.019339
Calcium (as Ca)	75	0.013333	4.744203	0.21078358	0.002810448	0	13.2	0.176	17.6	0.049464
Magnesium (as Mg)	30	0.033333	4.744203	0.21078358	0.007026119	0	0.9	0.03	3	0.021078
Chloride (as Cl)	250	0.004	4.744203	0.21078358	0.000843134	0	42.3	0.1692	16.92	0.014266
Flouride (as F)	1	1	4.744203	0.21078358	0.210783578	0	0.512	0.512	51.2	10.79212
Iron (as Fe)	0.3	3.333333	4.744203	0.21078358	0.702611925	0	0.006	0.02	2	1.405224
Nitrate (as NO_3)	45	0.022222	4.744203	0.21078358	0.00468408	0	37.32	0.829333	82.93333333	0.388466
	1814.8	4.744203			1					17.43187

Table-11: Calculation of WQI-Site7

SITE 7										
Charecteristics	BIS standards(Sn)	1/Sn	∑1/Sn	K=1/(∑1/Sn)	Wi=K/Sn	IDEAL VALUE (V0)	MEAN CONC.VALUE(Vn)	Vn/Sn	Vn/Sn*100=Qn	WnQn
Turbidity	5	0.2	4.744203	0.21078358	0.042156716	0	0.76	0.152	15.2	0.640782
pH	8.5	0.117647	4.744203	0.21078358	0.024798068	7	5.69	0.873	87.3	2.164871
Electrical conductivity at 25^0C	300	0.003333	4.744203	0.21078358	0.000702612	0	32.1	0.107	10.7	0.007518
Acidity			4.744203				7		0	0
Alkalinity	200	0.005	4.744203	0.21078358	0.001053918	0	17.3	0.0865	8.65	0.009116
Sulphate (as SO_4)	200	0.005	4.744203	0.21078358	0.001053918	0	3.18	0.0159	1.59	0.001676
Total Dissolved solids (TDS)	500	0.002	4.744203	0.21078358	0.000421567	0	170	0.34	34	0.014333
Total Hardness (as $CaCO_3$)	200	0.005	4.744203	0.21078358	0.001053918	0	55	0.275	27.5	0.028983
Calcium (as Ca)	75	0.013333	4.744203	0.21078358	0.002810448	0	15.4	0.205333	20.53333333	0.057708
Magnesium (as Mg)	30	0.033333	4.744203	0.21078358	0.007026119	0	4	0.133333	13.33333333	0.093682
Chloride (as Cl)	250	0.004	4.744203	0.21078358	0.000843134	0	57.7	0.2308	23.08	0.01946
Flouride (as F)	1	1	4.744203	0.21078358	0.210783578	0	0.723	0.723	72.3	15.23965
Iron (as Fe)	0.3	3.333333	4.744203	0.21078358	0.702611925	0	0.003	0.01	1	0.702612
Nitrate (as NO_3)	45	0.022222	4.744203	0.21078358	0.00468408	0	37.04	0.823111	82.31111111	0.385552
	1814.8	4.744203			1					19.36594

Table-12: Calculation of WQI-Site8

SITE 8										
Charecteristics	BIS standards(Sn)	1/Sn	∑1/Sn	K=1/(∑1/Sn)	Wi=K/Sn	IDEAL VALUE (V0)	MEAN CONC.VALUE(Vn)	Vn/Sn	Vn/Sn*100=Qn	WnQn
Turbidity	5	0.2	4.744203	0.21078358	0.042156716	0	0.74	0.148	14.8	0.623919
pH	8.5	0.117647	4.744203	0.21078358	0.024798068	7	6.39	0.4067	40.67	1.008537
Electrical conductivity at 25^0C	300	0.003333	4.744203	0.21078358	0.000702612	0	358	1.193333	119.3333333	0.083845
Acidity			4.744203				10		0	0
Alkalinity	200	0.005	4.744203	0.21078358	0.001053918	0	76.1	0.3805	38.05	0.040102
Sulphate (as SO_4)	200	0.005	4.744203	0.21078358	0.001053918	0	6.89	0.03445	3.445	0.003631
Total Dissolved solids (TDS)	500	0.002	4.744203	0.21078358	0.000421567	0	183	0.366	36.6	0.015429
Total Hardness (as $CaCO_3$)	200	0.005	4.744203	0.21078358	0.001053918	0	73.4	0.367	36.7	0.038679
Calcium (as Ca)	75	0.013333	4.744203	0.21078358	0.002810448	0	25.7	0.342667	34.26666667	0.096305
Magnesium (as Mg)	30	0.033333	4.744203	0.21078358	0.007026119	0	2.2	0.073333	7.333333333	0.051525
Chloride (as Cl)	250	0.004	4.744203	0.21078358	0.000843134	0	48.1	0.1924	19.24	0.016222
Flouride (as F)	1	1	4.744203	0.21078358	0.210783578	0	0.822	0.822	82.2	17.32641
Iron (as Fe)	0.3	3.333333	4.744203	0.21078358	0.702611925	0	0.007	0.023333	2.333333333	1.639428
Nitrate (as NO_3)	45	0.022222	4.744203	0.21078358	0.00468408	0	32.26	0.716889	71.68888889	0.335796
	1814.8	4.744203			1					21.27983

Table-13: Rating of WQI in each sampling stations

SAMPLES	WQI VALUE	WATER QUALITY STATUS
Sample 1	25.0136	GOOD
Sample 2	28.0047	GOOD
Sample 3	17.4318	EXCELLENT
Sample 4	27.3629	GOOD
Sample 5	18.5996	EXCELLENT
Sample 6	17.4319	EXCELLENT
Sample 7	19.3659	EXCELLENT
Sample 8	21.2798	EXCELLENT

6. SPATIAL DISTRIBUTION OF WATER QUALITY INDEX USING ArcGIS

ArcGIS is an effective tool for developing solutions for water resources problems. It is used for assessing and mapping of ground water quality. It understands the natural environment and managing water resources on the required scale. It manages the geographic information in a data base.

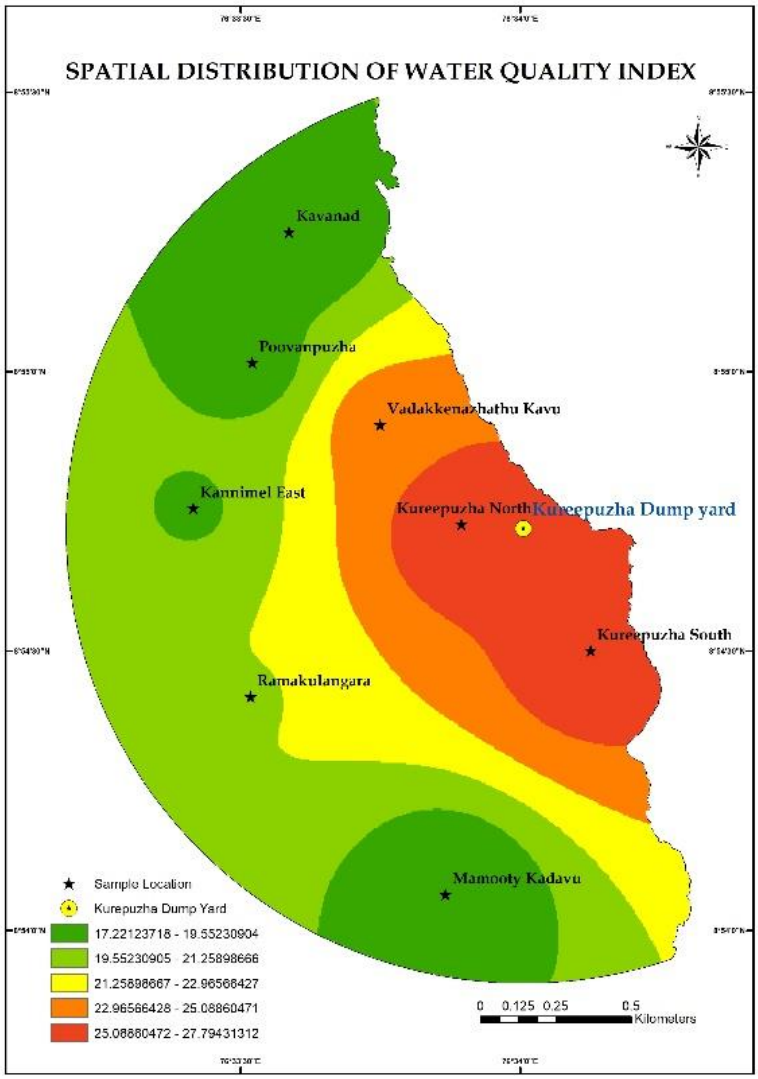


Fig-3: Spatial distribution of WQI

Table-14: Distribution Area

SI. No	WQI ZONE	PIXEL COUNT	AREA (m2)	AREA (km2)
1	17.221237 - 19.552309	36509	912725	0.912725
2	19.552309 - 21.258987	51902	1297550	1.29755
3	21.258987 - 22.965664	22741	568525	0.568525
4	22.965664 - 25.088605	18209	455225	0.455225
5	25.088605 - 27.794313	20855	521375	0.521375
			3755400	3.7554

6. CONCLUSIONS

- Analysis of water samples shows variation of values of parameters from BIS standards
- The study inferred that the aim of WQI is to give a single value to water quality of a source along with reducing higher number of parameters in to a simple expression.
- The WQI value indicates water is polluted.
- Water can used for drinking purpose only after conventional treatment and disinfection.
- The WQI map indicates that the distance from dump yard decreases, the pollution of water increases and vice versa.

7. REFERENCES

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